Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Expanding Flexible Use of the 3.7 to 4.2 GHz Band	)	GN Docket No. 18-122
	)	
Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz	)	GN Docket No. 17-183 (Inquiry Terminated as to 3.7-4.2 GHz)
	)	
Petition for Rulemaking to Amend and Modernize Parts 25 and 101 of the Commission's Rules to Authorize and Facilitate the Deployment of Licensed Point-to-Multipoint Fixed Wireless Broadband Service in the 3.7-4.2 GHz Band	)	RM - 11791
	)	
Fixed Wireless Communications Coalition, Inc., Request for Modified Coordination Procedures in Band Shared Between the Fixed Service and the Fixed Satellite Service	)	RM-11778

COMMENTS OF AVIATION SPECTRUM RESOURCES, INC.

1. INTRODUCTION

Aviation Spectrum Resources, Inc., ("ASRI") hereby provides these initial comments on the Commission's *Order and Notice of Proposed Rulemaking on Expanding Flexible Use of the 3.7 to 4.2 GHz Band* ("C-Band NPRM").[1] ASRI is the communications company of the US commercial aviation industry and is owned by the airlines and other airspace users. As sponsor of the Aeronautical Frequency Committee ("AFC"), ASRI brings together expertise and opinions

[1] Order and Notice of Proposed Rulemaking on Expanding Flexible Use of the 3.7 to 4.2 GHz Band, FCC 18-91, rel. Jul. 13, 2018.

from across the aviation sector to promote the safe and effective operation of commercial aviation radio communications and navigation systems in use within the U.S.[2]

ASRI reiterates the need to protect adjacent band aviation safety services such as radio altimeters and wireless avionics intra-communications ("WAIC") while ensuring continued access to the unique SATCOM spectrum that the C-band provides. This follows the high levels of support for action from multiple commenters representing the majority of the US aviation and aerospace industries in the previous Commission proceedings concerning the impact of potential new terrestrial service in the 3.7-4.2 GHz band.[3] Failure to engage in such deliberate and careful consideration of these safety services poses a significant potential for loss of life for both domestic and international users of these aviation safety systems.

2. AVIATION USAGE IN AND ADJACENT TO 3.7-4.2 GHZ

C-band SATCOM - 3.7-4.2 GHz

C-band plays a small but significant role in aviation and weather data distribution. The system provides an exceedingly high level of availability compared to Ku and Ka SATCOM systems, especially during moderate to extreme weather conditions. This unique property for an

[2] AFC membership includes: Airline and Pilots Association (ALPA), Airlines for America (A4A), Alaska Airlines, American Airlines, Aircraft Owners and Pilots Association (AOPA), ARINC/Rockwell Collins IMS, Aviation Spectrum Resources, Inc. (ASRI), Boeing Corporation, Bristow Helicopters, Chevron, Delta Airlines, Era Helicopters, Federal Aviation Administration (FAA), Federal Express (FedEx), Frontier Airlines, Harris Corporation, Helicopter Association International (HAI), Helicopter Safety Advisory Conference (HSAC), International Air Transport Association (IATA), JetBlue Airways, National Air Transportation Association (NATA), PHI, Inc., Societe Internationale de Telecommunications Aeronautique (SITA), Southwest Airlines, United Airlines, United Parcel Service (UPS).

[3] See comments from A4A, AIA, ALPA, AOPA, ASRI, Boeing Corporation, General Aviation Manufacturers Association ("GAMA"), HAI, IATA, Delta Airlines, Rockwell Collins, and UPS in GN Docket No. 18-122 in response to the Commission's Public Notice.

FSS system means C-band SATCOM is used worldwide for the backhauling of important aviation data from remote sites or as a redundant secondary link for emergencies should local infrastructure fail. Local hard-wired infrastructure cannot either physically or economically replace such a capability, and therefore C-band SATCOM must always have a place in planning for a comprehensive national communications infrastructure in both remote and urban areas.

Radio Altimeter - 4.2-4.4 GHz

Radio altimeters serve an essential safety-of-life function in landing/take-off, low level maneuvering, and avoiding changes in terrain that may not be visible at night or during bad weather. The system has significantly improved aviation safety for all aircraft types since its introduction in the 1970's. This was prompted by a number of aviation incidents of aircraft flying unintentionally into the ground, a circumstance formally known as Controlled Flight Into Terrain ("CFIT"). Since its widespread adoption, major CFIT accidents in the United States have been reduced to almost minimal levels, and radio altimeters are mandated equipment for many aircraft, increasing the safety and efficiency of all major commercial air travel providers. Therefore, all aircraft, including helicopter and general aviation airframes, should be assumed to be carrying at least one radio altimeter.

A radar-based system, commercial radio altimeter avionics use either Frequency Modulated Continuous Wave ("FMCW") or pulses to continually report the distance to the terrain below the aircraft. The system operates in all phases of flight, from operation on the ground to high cruising altitudes, and adapts its operation depending on the reported altitude. Low level flight is the most critical, requiring less than 3 ft of resolution to ensure accurate navigation and landing by either the pilot or autopilot depending on the aircraft approach type.

This is achieved by the altimeters increasing the swept or pulsed signal bandwidth to nearly the full 200 MHz Aeronautical Radio Navigation Service (ARNS) allocation.

Both transmitter and receiver are mounted on the underside of the aircraft, pointing in a downwards direction slightly ahead of the aircraft's direction of travel. The system also feeds the Ground Proximity Warning System ("GPWS"), alerting pilots to possible obstructions that may endanger the aircraft. This feature is critical to low level aircraft such as helicopters, operating in close proximity to the ground in any area required for the mission.

WAIC – 4.2 – 4.4 GHz

The WAIC system is a newly developed capability for commercial aviation, eliminating redundant wiring to increase airframe redundancy and flexibility. Intended only for communications between points on the same aircraft, WAIC network points are planned to be installed for both internal and external applications to create a local wireless network for the aircraft. Planned applications include more high data applications such as wing tip cameras for aircraft navigation and taxiing, to sensors built into moving engine parts that cannot be wired.

Supporting both data and voice communications, WAIC systems are limited to the safe, reliable and efficient operation of an aircraft. They are not intended to provide communications with consumer devices brought onboard the aircraft by passengers or for in-flight entertainment applications. Rather, they are assumed to be part of the aircraft's exclusive network. WAIC was given an AM(R)S allocation at WRC-15 and is being developed into internationally recognized aviation standards in the US and Europe for deployment on aircraft soon.

3. RADIO ALTIMETER TESTING

During the process to establish a co-frequency AM(R)S allocation for WAIC with the existing ARNS radio altimeter allocation, it was necessary to create generic RF performance characteristics for all existing radio altimeters. ITU-R Recommendation M.2059 was developed for WRC-15 and provides a large amount of detail based on system parameters provided by the major radio altimeter manufacturers.[4] However, adjacent band considerations were not investigated in detail. Yet, since WRC-15, it has become clear that national regulators are considering options in the 3.7-4.2 GHz band. Preliminary theoretical studies in ICAO have shown a significant impact from adjacent band interference using these characteristics, and the aviation community has recognized a need to refine these parameters to provide an accurate RF model of the radio altimeter's receiver performance. Therefore, the international aviation community, through the UN aviation agency, the International Civil Aviation Organization ("ICAO"), began a formal work program in 2016 to start testing existing altimeters to benchmark their performance, especially in context of adjacent band interference.[5]

The testing has been implemented through the Aerospace Vehicle System Institute ("AVSI"), a consortium of major aerospace and avionics manufacturers with support from the FAA, IATA and ASRI.[6] Having started in early 2018, the testing has a target completion date by the end of 2018. While tests have not been completed on all available avionics, interim results have indicated that the adjacent 100 MHz (4.1-4.2 and 4.4-4.5 GHz) is of most concern to the

[4] ITU-R Recommendation M.2059-0: Operational and technical characteristics and protection criteria of radio altimeters utilizing the band 4 200-4 400 MHz (02/2014) https://www.itu.int/rec/R-REC-M.2059/en

[5] ICAO job card https://www.icao.int/safety/FSMP/Documents/Job%20Cards/FSMP_JobCard.06.01.pdf

[6] https://avsi.aero/

radio altimeter receivers, with relatively high power OFDM signals creating an overload condition that prevents an accurate or computable altitude from being reported to the aircraft systems and pilot. Once aviation has a complete assessment of the radio altimeter performance, it will be made available to the necessary organizations and aviation standards organizations to assess and adopt.

4. NECESSARY PRECAUTIONS FOR AVIATION SAFETY SYSTEMS

Given the preliminary results from the radio altimeter testing, it is clear there are significant concerns that should be addressed before the Commission considers repurposing certain parts of the 3.7-4.2 GHz band. If interference was received in real world aircraft operations, it would create an immediate safety issue that would threaten aircraft safety in the area affected and significantly reduce operations until the source of interference had been identified and turned off. Therefore, identifying potential system interactions and necessary spectrum mitigations before implementing regulatory changes would benefit all parties involved.

Given the implications of the above, ASRI strongly recommends that the Commission engage the FAA to fully assess the potential for radio altimeter interference before allowing commercial wireless operations in the upper part of the 3.7 to 4.2 GHz band. Such a special assessment should include both receiver overload and in-band interference to the altimeter. The completed AVSI testing would provide for accurate data to ensure the protection of aviation safety and could be combined with operational measures that would further mitigate interference. Such a process would ensure suitable protection for both aviation safety systems, and also reduce potential interference to 5G systems that could be affected by the radio altimeter emissions.

5. COMMENTS ON C-BAND ALLOCATION PROPOSALS

In reviewing potential options for reallocation, ASRI encourages the Commission to seek an appropriate balance in creating suitable 5G infrastructure, while not removing an irreplaceable capability that C-band SATCOM provides. Such a SATCOM capability will be needed both now and in the future. In studying the current proposals, ASRI believes the C-Band Alliance ("CBA") concept would allow a more controlled yet quicker introduction of 5G through secondary markets.[7] Such an approach would have significant benefits for all SATCOM and 5G communities and potentially mitigate a large part of the aviation concerns for the adjacent ARNS allocation.

[7] C-Band Alliance FCC Proposal: www.c-bandalliance.com

6. SUMMARY

The C-band is a unique resource that allows for reliable SATCOM that cannot be met in other FSS bands. The Commission should take a measured approached to any reallocation mechanism, especially given the special considerations required under ITU-R Article 4.10 for potentially affected safety services used by the flying public. Given these requirements and based on the current information at hand, the CBA proposal presents the most viable approach for all C-band interests to ensure a managed and timely transition to 5G in certain parts of the lower 3.7-4.2 GHz band.

Respectfully Submitted,

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October 29, 2018